

## **APPENDIX F**

***Invasive Weed Report for the Santa Maria Creek  
Restoration Project: grassland and riparian invasive  
weed control efforts and results (Kelly & Associates  
2007)***

# **Invasive Weed Report for the Santa Maria Creek Restoration Project:**

## **Grassland and Riparian Invasive Weed Control Efforts and Results**

Prepared for:  
County of San Diego  
Department of Parks and Recreation  
5201 Ruffin Road, Suite P  
San Diego, CA 92123  
Contact: Jennifer Haines

Prepared by:  
Mike Kelly  
Kelly & Associates  
11591 Polaris Dr.  
San Diego CA 92126  
mkellysd@aol.com  
858-342-8856

On behalf of:  
Technology Associates (TAIC)  
9089 Clairemont Mesa Blvd, Suite 307  
San Diego, CA 92123  
Contact: Christina Schaefer

January 2007



## Table of Contents

| <b>Contents</b>                               | <b>Page</b> |
|---|-------------|
| INTRODUCTION .....                            | 1           |
| Project Location .....                        | 1           |
| Project Description.....                      | 1           |
| SURVEYS .....                                 | 3           |
| Goals .....                                   | 7           |
| Methods.....                                  | 7           |
| RESULTS .....                                 | 9           |
| Artichoke Thistle Control .....               | 10          |
| Riparian Exotics Control.....                 | 11          |
| Non-Native Grass Control Through Grazing..... | 12          |
| REFERENCES .....                              | 13          |

## List of Tables

| <b>Table</b>  | <b>Page</b> |
|---|-------------|
| Table 1. Herbicides and adjuvants .....                                       | 8           |
| Table 2. Controlled invasive species and associated herbicide quantities..... | 10          |

## List of Figures

| <b>Figure</b>   | <b>Page</b> |
|---|-------------|
| Figure 1. Project Location.....   | 1           |
| Figure 2. Location of Invasive Weeds within the Ramona Grasslands 1, including artichoke<br>thistle.....          | 4           |
| Figure 3. Location of Invasive Weeds within the Ramona Grasslands 2, including milk thistle<br>and Lepidium ..... | 5           |
| Figure 4. Location of Invasive Weeds within the Ramona Grasslands 3, including eucalyptus<br>groves.....          | 6           |
| Figure 5. Invasive Weeds Treated in 2005 and 2006.....  | 9           |

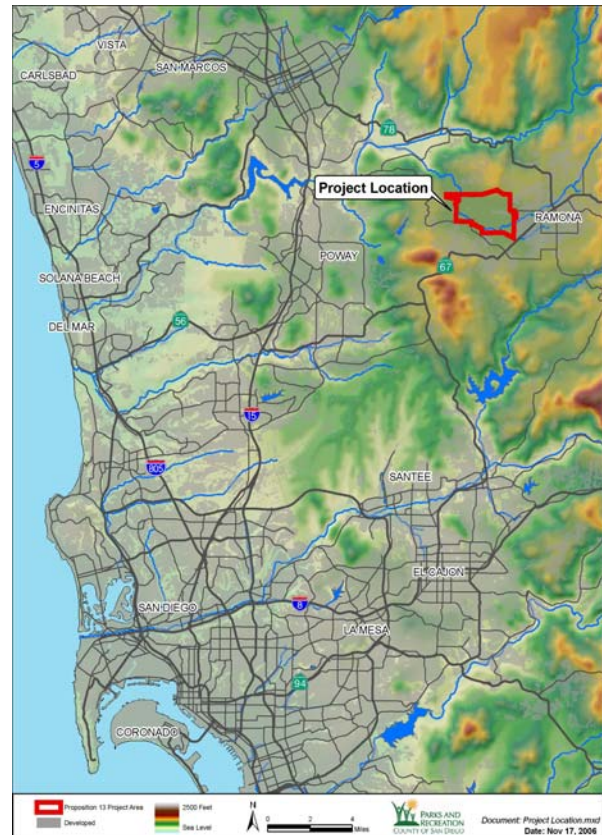




## INTRODUCTION

### Project Location

The invasive species control portion of the Santa Maria Creek Restoration project was performed within a core preserve area known as the Ramona Grasslands Preserve (RGP). RGP is located in the vicinity of the Santa Maria Creek and the Ramona Airport in the western portion of the community of Ramona, San Diego County, California (Figure 1). The preserve area includes properties currently owned by The Nature Conservancy, including the former Cagney Ranch, the Hardy property, Oak Country Estates, the Hobbs property, and Eagle Ranch. Adjacent landowners, including Wildlife Research Institute (WRI), selected Voorhes Lane properties, Cumming Ranch, the County's Ramona Airport open space, Martz, and the Ramona Water District were given the opportunity to take part in this project. Only properties with landowner consent were included in project activities.



**Figure 1. Project Location**

Most of the properties have been used as livestock pasturage, but were formerly part of a large expanse of native grassland. These locations have been identified by the proposed North County Multiple Species Conservation Program (MSCP) Subarea Plan as areas of very high quality habitat and, as such, have been included in the planned preserve area.

### Project Description

The County of San Diego Department of Parks and Recreation was awarded a Proposition 13 Grant by the California Water Resources Control Board for the Santa Maria Creek Protection and Restoration Project. The purpose of the grant is to protect and restore Santa Maria Creek and its adjacent watershed areas within the Ramona Grasslands Preserve, the project area, (hereinafter referred to as “Ramona Grasslands”), to improve water quality and habitat

conditions in the creek corridor. Santa Maria Creek has been subjected to unmanaged cattle grazing, which has resulted in elevated suspended sediment concentrations, bacteria, and nutrients in the stream. In addition, increasing urbanization in the town of Ramona, upstream of the project area, has contributed urban, non-point source runoff to the stream. Land uses upstream of the Ramona Grasslands are largely rural residential, but development densities are projected to increase in the future according to General Plan 2020 of the County of San Diego. The Santa Maria Creek Protection and Restoration Project will prevent residential development in the Ramona Grasslands, thus eliminating a future source of urban runoff to Santa Maria Creek and downstream receiving waters. The project will also manage cattle grazing by limiting access of livestock to the creek corridor with fencing, thus eliminating a source of agricultural pollutants and allowing stabilization of the channel and restoration of riparian and wetland vegetation to enhance riverine functions in the creek system. A second component of the project consists of collecting baseline biological data according to the Ramona Grasslands Framework Management Plan (CBI 2004), which will facilitate preserve management decision-making and track responses to management actions to refine recommended monitoring protocols. Baseline data will enable preserve managers to:

- Measure the success of the non-native plant species removal and restoration program.
- Measure changes in the physical condition and hydrology of the creek and ephemeral aquatic habitats (vernal pools, vernal swale, and alkali playas), and their watersheds.
- Track changes in the current distribution and abundance of management target species.
- Understand the distribution of non-native animal species.
- Provide a benchmark to which all subsequent monitoring data can be compared, realizing that the “typical” and historic conditions of the Grasslands are unknown.

The target species selected for the baseline surveys are the arroyo toad (*Bufo californicus*), riparian bird species, raptors, and Stephens' kangaroo rat (*Dipodomys stephensi*). In addition, vernal pools were surveyed for fairy shrimp, amphibians, and plant species. Grassland floral surveys and vegetation transects across Santa Maria Creek were also performed.

The proposed project includes a restoration plan that will help restore the integrity of the native grassland and riparian habitats within the preserve. This will be accomplished through a multi-year comprehensive removal and control of invasive non-native plant species, which have been shown to rapidly outcompete native plant species, alter natural hydrologic patterns, and provide poor foraging and nesting habitat for native wildlife. Specifically, artichoke thistle (*Cynara cardunculus*) has been rapidly spreading in the grasslands and is the major removal target for exotic species control. Two other invasive weeds are of concern in the grasslands, milk thistle

(*Silybum marianum*) and intermediate wheatgrass (*Elytrigia intermedia*). It should be noted that these species are not eaten by the cattle present on the range, while the cattle do eat the other grassland species. The cattle can also spread the seed of these species by carrying them on their hooves (pers. obs.) Riparian invasive weeds include salt cedar (*Tamarix ramosissima*), giant reed (*Arundo donax*), and milk thistle. The following sections describe the methods and results of the invasive weed control work that was conducted by Kelly & Associates from November 2005 through August 2006. The significance of these results and recommendations for future monitoring and control efforts will be discussed as well.

## **SURVEYS**

Field work was conducted throughout the Year 2 exotic species treatment season between winter 2005 and summer 2006 by Kelly & Associates, in coordination with TAIC. Year 1 exotic species control was performed by Recon (Recon 2005) under contract with the County of San Diego Department of Public Works. Maps, provided by TAIC, of the invasive weed populations of the project area were ground-truthed in the field. These maps were based on data from a previous contractor that worked the grasslands in 2005 (Recon 2005) and were found to be largely accurate. However, two exceptions were found:

1. Salt cedar in the western reach of the creek on the Oak Country Estates parcel had not been mapped. The plants appeared to be 2-3 years old and can be difficult to see, especially with the recent thick growth of mule fat in several reaches of the creek.
2. A population of artichoke thistle was found on the southwestern portion of the Oak Country Estates parcel. The plants were mature and had seed heads from previous years and had not been treated in 2005. Access to this population was difficult, with no road or trail crossing this portion of the property, and the population was difficult to see from a distance until mature plants bolted later in the year. This population is mapped as Patch 11. A total of 362 plants, mature multi-year and seedlings alike, were controlled.
3. Artichoke thistle within the new acquisition parcel on Eagle Ranch were treated by The Nature Conservancy.

Invasive weed distribution within the Ramona Grasslands is illustrated in Figures 2, 3, and 4. Surveys revealed that the year 2005 control effort had not prevented flowering and seed production. Control efforts were conducted late in the season (Bruce Hanson, pers. comm.). It was estimated that more than 75% of the mature plants had gone to seed. This seed has been observed to have an average longevity of five years (Kelly 2000). Mapping of herbicide treatment methods in the previous year indicated that the main herbicide, Transline, had been applied too late in the season to be effective. This possibly accounts for the high rate of plants observed resprouting from previous year's plant biomass.





Figure 2. Location of Invasive Weeds within the Ramona Grasslands 1, including artichoke thistle.





Figure 3. Location of Invasive Weeds within the Ramona Grasslands 2, including milk thistle and Lepidium.





Figure 4. Location of Invasive Weeds within the Ramona Grasslands 3, including eucalyptus groves.



## Goals

There were several major goals at the beginning of the 2005/2006 weed season:

1. Sweep the creek on the publicly owned and privately permitted parcels and kill the major invasives (saltcedar, arundo, milk thistle).
2. Kill all mature, reproductive artichoke thistle before it had a chance to flower and set seed. Mature, reproductive plants have a deep tap root with large underground storage tubers.
3. Begin the process of exhausting the seed bank of artichoke thistle. This plant is a deep and relatively long-lived seed (Kelly 2000).
4. Stop the relatively new infestations of milk thistle and intermediate wheatgrass before they had a chance to spread beyond their introduction foci.
5. Map new populations of these invasive weeds.

## Methods

Two methods were used to control the weeds. The most frequently used method was to spray herbicides where and when most appropriate. A 50-gallon truck sprayer was used when dense concentrations of plants occurred, while backpack sprayers were used in less dense situations. No matter which tool was used, for the most part the applications were a spot spray, not a broadcast spray application. A second method was to use a “cut stump” technique on arundo and saltcedar. The saltcedar or arundo is cut with loppers, chainsaw, or handsaw, then a concentrated herbicide is applied to the cut stump within one minute of cutting.

The herbicides used were Transline, Garlon 4a, Pathfinder (a pre-mix of Garlon 4a in a seed oil base) Glypro Pro (a Glyphosate herbicide, a generic Roundup), and Fusilade II; application quantities varied (Table 1). Transline and Garlon 4a are broadleaf specific herbicides. Transline, approved for Rangeland use with cattle present, is most effective when used at the basal stage of artichoke thistle. It begins to lose effectiveness when artichoke bolts, when it erupts from its basal stage and grows upwards, including sending up the flowering stalk. At that point, Garlon 4a and Glyphosate Pro (generic Roundup), become more effective. Glypro Pro is a non-specific herbicide, controlling both dicots and monocots. Once the plants were bolting in the field, Kelly & Associates shifted to a cocktail of Transline and either Garlon 4a or GlyPro II. Keeping Transline in the cocktail of herbicides was important because the herbicide has a pre-emergent effect on the next year's growth, killing emerging seedlings.



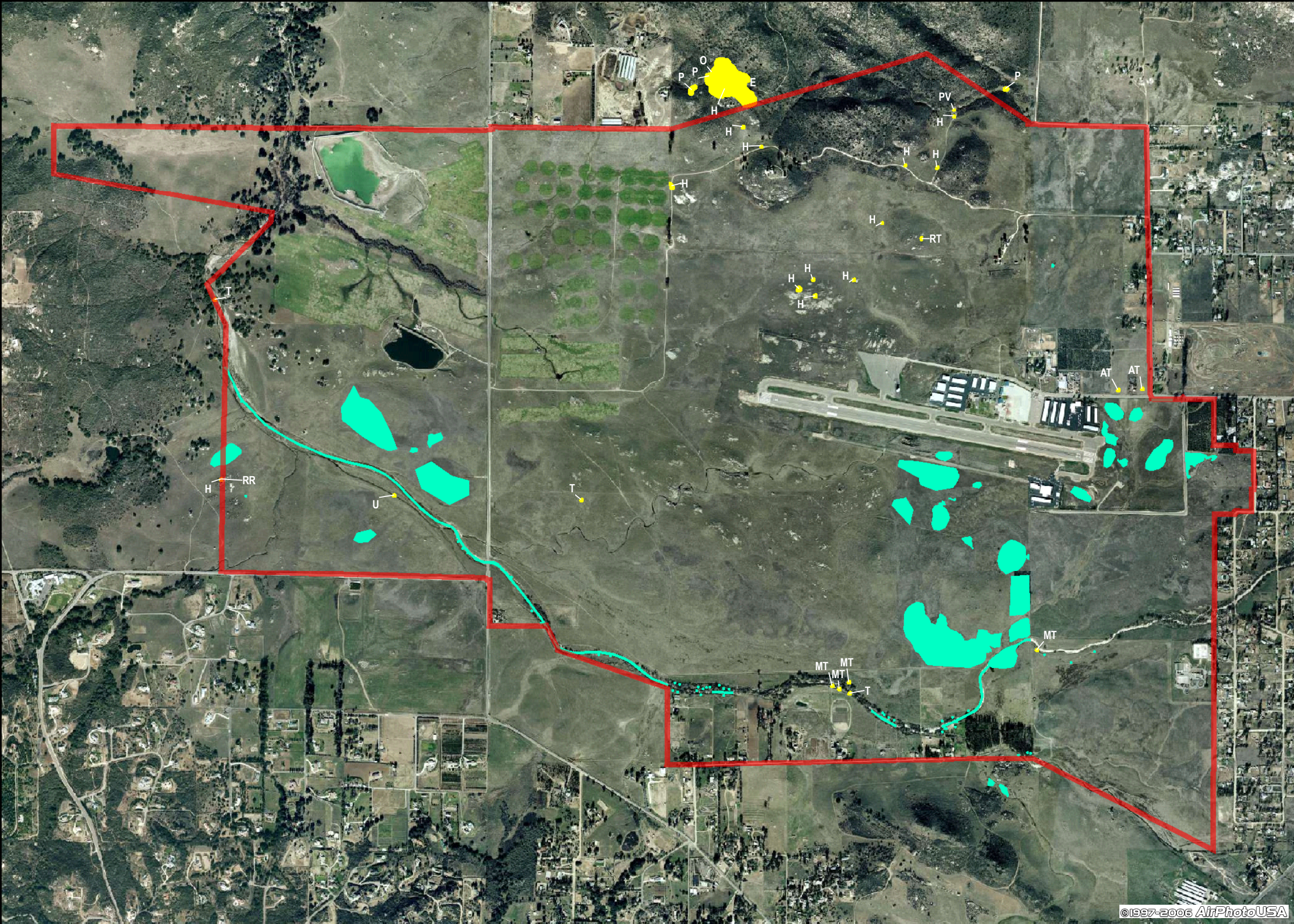
**Table 1.** Herbicides and adjuvants

| <b>Herbicide</b>                             | <b>Quantity</b> |
|--|-----------------|
| Glyphosate                                   | 95 ounces       |
| Garlon 4a (or Pathfinder)                    | 233 ounces      |
| Transline                                    | 174 ounces      |
| Surfactant                                   | 195 ounces      |
| Fusilade                                     | 5 ounces        |
| Blazon dye                                   | 395 ounces      |
| Total of Transline & water mix sprayed       | 696 gallons     |
| Total of other herbicide & water mix sprayed | 5 gallons       |

All references to Transline assume the rate of herbicide used was the same, i.e., 0.25 oz of Transline per gallon of water with both surfactant and dye added. This was consistent throughout the season. Garlon 4a was used at 1% (1.33 oz per gallon of water) and mixed with Transline. Glypro Pro was used at 1% and mixed with Transline. Fusilade II is a grass specific herbicide. Fusilade II was used at the rate of 1 oz per gallon of water. Pathfinder is strictly used in cut stump applications at full strength. The numbers of weeds controlled are based on counting the first backpacks or truck spraying counts per gallon, then extrapolating times the total number of gallons of spray mix used in that patch that day. An error rate of +/- 5% would be reasonable. If anything, given the volume of small seedlings in the count, the total is probably on the low side.

All the major patches of artichokes were visited and sprayed an average of 5 times (see Appendix A for a chronological application schedule). A final sweep of the riparian was conducted in two visits in July and August.

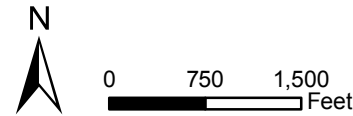




**Legend**

- Proposition 13 Project Area
- Untreated Exotic Plants
- Treatment Areas

- AT = Artichoke Thistle
- E = Eucalyptus
- H = Horehound
- L = Lepidium
- MT = Milk Thistle
- O = Olive Tree
- PV = Palo Verde
- P = Pepper Tree
- RR = Rhynchelytrum repens
- RT = Russian Thistle
- T = Tamarisk
- U = Unknown exotic bunchgrass



**Technology Associates**  
INTERNATIONAL CORPORATION

Document: ExoticPlantTreatment\_TechRept.mxd  
Date: Jan 19, 2007

©1997-2006 AirPhotoUSA

Figure 5. Invasive Weeds treated in 2005 and 2006.



## RESULTS

After termination of the Year 2 invasive species treatment season, no invasive species remained in the Ramona Grasslands and associated Santa Maria Creek riparian habitat with the exception of those outside of this scope (e.g., some invasives were treated by The Nature Conservancy outside this scope, and detailed information is not available). The eradicated species and associated herbicide quantities are stated in Table 2 below and shown on Figure 5 (see previous page).

**Table 2.** Controlled invasive species and associated herbicide quantities.

| Invasive Weed Species   | Quantity (*individuals)<br><small>*unless stated otherwise</small> |
|-------------------------|--|
| Artichoke Thistle       | 193,541  |
| Milk Thistle            | 2,236  |
| Intermediate Wheatgrass | 675 bunches  |
| Lepidium, a net         | 0.008 acre   |
| Tamarix                 | 419  |
| Arundo                  | 3 clumps   |
| Pampas grass            | 8  |
| Polypogon grass         | 2 bunches  |

### Artichoke Thistle Control

All of the patches previously mapped developed in several waves of dense plants. Early in the season, the patches tended to be composed of as many re-sprouts rather than seedlings. Starting from the underground perennial tuber, these plants emerge and grow faster than seedlings. Most resprouting tubers emerge earlier in the season than seedlings. After the first artichoke control sweep of the grasslands, the re-growing plants tended to be seedlings and therefore smaller. Despite the below average season total of rainfall, the timing of the rainfalls and the amount of rain with each storm served to bring up several robust waves of artichoke seedlings, thus beginning the process of depleting the seed bank.

A final examination of the artichoke fields in August 2006, after the germination and flowering season for artichoke, found no plants that survived to flower or set seed, achieving the major goal of this contract. Year 3 treatments, however, will be conducted as necessary and feasible in the winter of 2006/2007.

## **Riparian Exotics Control**

Invasive control in the riparian habitat was less difficult than control in the grasslands, for two reasons. First, Year 1 treatment was successful on arundo and tamarisk. Since milk thistle treatment was not part of the original Year 1 treatment scope, this plant was not treated prior to Year 2. By the time the artichokes had been controlled it was too late for milk thistle control, the latter having gone to seed (Bruce Hanson, pers. comm.). Second, there is no seed bank for tamarisk and arundo. Tamarix seed lasts 1-2 days, is wind-borne, and must fall on wet, open soil or sand. Arundo is not known to produce viable seed. Hence, once mature invasive species such as these are controlled in a riparian system, follow-up maintenance, while needed, tends to be light and focused on new seedlings (there's always tamarisk seed in the air!).

At the final sweep in the riparian corridor all known tamarisk, arundo and milk thistle were eliminated. A lack of additional rain and hot weather should prevent further seed germination for this season.

## **RECOMMENDATIONS**

### **Future Invasive Week Control Efforts**

Artichoke control should be continued for a total of five years to guarantee eradication. Future contracts for invasive weed control should require that invasives be controlled prior to seed set. This will prevent the augmentation of the seed bank, which in the case of artichoke thistle is about five years. Riparian invasives is likely to remain light until new property owners give permission to enter their parcels for the first time. Several of the non-accessible parcels have significant patches of arundo and large tamarisk.

Old locations of artichoke should show a significant drop-off in the number of artichokes resprouting or germinating in 2007. After the 2007 season of control, future years (2008 onward) should show an exponential drop-off in artichokes. By 2009 the artichoke problem should be a relatively light maintenance item. By 2011, this weed, if no plants have been allowed to flower and set seed in previous seasons, should be eradicated except the occasional plant from a deep seed. Kelly & Associates have eliminated this weed completely from a number of locations, with many years of no artichokes showing, from sites as bad as the Ramona grasslands.

In the future, with the resprouting artichokes no longer expected to be a factor, the number of sweeps can be reduced to 2 to 3 depending on the amount and pattern of rainfall.

## **Non-Native Grass Control Through Grazing**

Kelly & Associates would recommend mapping and monitoring the location and quantity of ungrazed grassland. It was our impression that several sizeable areas were not grazed much, leaving a large fuel load for possible fire and a large non-native grass biomass and seed source. We don't know if this was deliberate this year because of the riparian fencing project getting underway, or due to cattle indifference to the type of grass present, or too little grazing "pressure" in general. This mapping and monitoring could be important to document if there are major weed grasses that cattle are not controlling.

## REFERENCES

Kelly, Mike. 2000. *Cynara cardunculus* in Bossard, C., J. Randall, and M. Hoshovsky. Invasive Plants of California's Wildlands. Univ. of California Press, Berkeley. 2000.

Conservation Biology Institute (CBI). 2004 Framework Management and Monitoring Plan for Ramona Grasslands Open Space Preserve, San Diego County, California. Prepared for the Nature Conservancy, October 2004.

## APPENDIX A

| Date       | Location (Patch) | Treatment | Species Treated                   |
|------------|------------------|-----------|-----------------------------------|
| 11/30/2005 | Patch 9          | Transline | artichoke thistle                 |
|            | along creek      | Transline | milk thistle,<br>tamarisk, arundo |
| 12/27/2005 | Patch 1          | Transline | artichoke thistle                 |
|            | Patch 2          | Transline | artichoke thistle                 |
|            | Patch 3          | Transline | artichoke thistle                 |
|            | Patch 4          | Transline | artichoke thistle                 |
| 12/28/2005 | Patch 4          | Transline | artichoke thistle                 |
|            | Patch 5          | Transline | artichoke thistle                 |
|            | Patch 6          | Transline | artichoke thistle                 |
| 12/29/2005 | Patch 6          | Transline | artichoke thistle                 |
| 1/4/2006   | Patch 6          | Transline | artichoke thistle                 |
|            | Patch 8          | Transline | artichoke thistle                 |
| 1/5/2006   | Patch 9          | Transline | artichoke thistle                 |
| 1/6/2006   | Patch 6          | Transline | artichoke thistle                 |
|            | Patch 7          | Transline | artichoke thistle                 |
| 2/24/2006  | Patch 1          | Transline | artichoke thistle                 |
|            | Patch 2          | Transline | artichoke thistle                 |
|            | Patch 3          | Transline | artichoke thistle                 |
|            | Patch 4          | Transline | artichoke thistle                 |

|           |                         |  |                                    |
|-----------|-------------------------|--|------------------------------------|
| 3/1/2006  | Patch 2                 | Transline                                | artichoke thistle                  |
|           | Patch 3                 | Transline                                | artichoke thistle                  |
|           | Patch 5                 | Transline                                | artichoke thistle                  |
|           | Patch 6                 | Transline                                | artichoke thistle                  |
|           | Patch 8                 | Transline                                | artichoke thistle                  |
| 3/2/2006  | Patch 5                 | Transline                                | artichoke thistle                  |
|           | Patch 6                 | Transline                                | artichoke thistle                  |
|           | Patch 8                 | Transline                                | artichoke thistle                  |
| 3/27/2006 | Patch 9                 | Transline                                | artichoke thistle                  |
| 4/18/2006 | Patch 9                 | Transline, glyphosate<br>and Fusilade II | artichoke thistle,<br>pampas grass |
|           | Patch 6                 | Transline                                | artichoke thistle                  |
| 5/17/2006 | Patch 6                 | Transline                                | artichoke thistle                  |
| 5/23/2006 | Patch 1                 | Transline / Garlon 4<br>cocktail         | artichoke thistle                  |
|           | Patch 4                 | Transline / Garlon 4<br>cocktail         | artichoke thistle                  |
|           | Patch 2                 | Transline / Garlon 4<br>cocktail         | artichoke thistle                  |
|           | Patch 3                 | Transline / Garlon 4<br>cocktail         | artichoke thistle                  |
| 5/24/2006 | Patch 1                 | Not specified                            | artichoke thistle                  |
|           | Patch 4                 | Not specified                            | artichoke thistle                  |
|           | Patch 5                 | Not specified                            | artichoke thistle                  |
|           | Patch 6                 | Not specified                            | artichoke thistle                  |
|           | Patch 7                 | Not specified                            | artichoke thistle                  |
|           | N 33.03625 W -116.94764 | Not specified                            | artichoke thistle                  |



|           |  |                            |                        |
|-----------|--|----------------------------|------------------------|
| 6/19/2006 | Patch 11   | Transline & Glyphosate Pro | artichoke thistle      |
|           | Patch 1  | Transline                  | artichoke thistle      |
|           | Patch 2  | Transline                  | artichoke thistle      |
|           | Patch 3  | Transline                  | artichoke thistle      |
|           | Patch 4  | Transline                  | artichoke thistle      |
|           | Eucalyptus Plantation  | Transline                  | artichoke thistle      |
|           | Patch 9  | Transline                  | artichoke thistle      |
|           | Patch 6  | Transline                  | artichoke thistle      |
|           | Patch 7  | Transline                  | milk thistle           |
|           | Nursery fence line   | 5% Glyphosate mix          | Lepidium               |
| 7/6/2006  | Patch 6  | Transline                  | artichoke              |
|           | east of Rangeland in Creek   | Glyphosate                 | tamarisk               |
| 8/10/2006 | in Creek, ranging from bridge at Rangeland to parcel boundary in northeast | pure glyphosate            | tamarisk, tree tobacco |